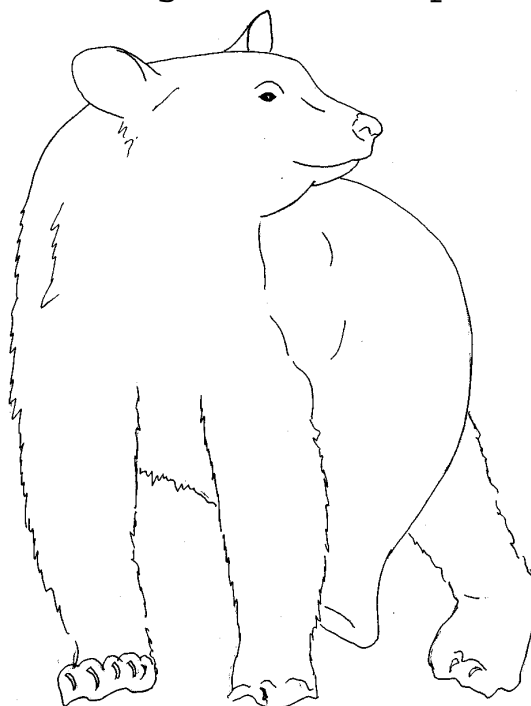


Investigating Fire Ecology

Post-Field Trip Lessons

9. What Does It All Mean? Analysis of Plot Data.....145-150
10. Using Observations to Express Feelings:
Writing and Photo Collage.....151-153
11. Wildfire and Native Plants: Creating a Field Guide.....155-159
12. Developing a Forest Management Plan: Managing the Impact of
Wildfire on Communities and Ecosystems.....161-170
13. Be Prepared: Creating a Defensible Space.....171-176



WHAT DOES IT ALL MEAN? POST-FIELD TRIP DATA ANALYSIS OF FOREST DENSITY PLOTS



FOCUS QUESTIONS

How can we quantify a healthy and an unhealthy forest?

How can we use data to create a healthier forest?

OVERVIEW OF LESSON PLAN

This interdisciplinary unit combines mathematics, science, and technology. Students will use forest density data collected on a field trip to analyze forest structure and compare pre- and post-settlement forests. Using their analysis and background, they will write a prescription for creating a healthier forest.

SUGGESTED TIME ALLOWANCE:

Class Time: 2 hours

LOCATION:

Classroom or computer lab

SUBJECT AREAS: Language Arts, Social Studies, Science, Math, Technology

STUDENT OBJECTIVES

Students will:

- Demonstrate mathematical skills by calculating forest density on two plots

- Analyze scientific data collected in the field

- Describe quantitatively the characteristics of a healthy forest and an unhealthy forest

- Use their findings to make a recommendation for thinning a dense forest stand

VOCABULARY

- Thinned

- Unthinned

- Competition

- Biodiversity

- Diameter breast height (DBH)

- Tree basal area

MATERIALS

- Pencils

- Forest Plot Data Sheets

- Calculators

- Computers and spreadsheet software (optional)

PROCEDURES

Data Analysis

For this study, students can use either the data their group collected on the field trip, or use data provided on the enclosed data sheets.

1. Calculate the number of trees per acre on thinned and unthinned plots
 - a. Count the number of trees on the thinned subplot and enter the value on the data sheet. Multiply the number of trees by four to find the estimated number of trees on the entire 50-meter by 20-meter plot, and record the number. Because each plot is about 1/4 acre, multiply the number of trees on the entire plot by four to find the number of trees per acre. Record the answer on the data sheet.
 - b. Repeat the calculation of trees per acre for the unthinned plot.
2. Calculate the average diameter of the trees in the plot.
 - a. Use a calculator to add up all the tree diameters in the thinned subplot. Divide the answer by the number of trees on the subplot to find the average diameter. Record the answer on the data sheet.
 - b. Use a calculator to add up all the tree diameters on the unthinned subplot. Divide the answers by the number of trees on the subplot to find the average diameter. Record the answer on the data sheet.
3. Estimate the area of the thinned subplot that is covered by tree trunks, which is called the total basal area of trees.
 - a. Use the average diameter of the trees to find the average basal area. To do this, first find the radius of the average tree (r) by dividing the average diameter by 2. The average basal area of trees is:
$$\text{Tree Basal Area} = 3.14 \times r \times r$$
Multiply the average area by the number of trees in the subplot to estimate the total basal area. Record the answer on the data sheet.
 - b. Use the same calculations to find the total basal area on the unthinned plot. Record the answer on the data sheet.
4. Calculate the average percent cover for the thinned and unthinned subplots and record the answer.
5. Calculate the average number of species for each subplot and record the answer.

QUESTIONS FOR CLASS DISCUSSION

1. Compare the number of trees per acre for subplot data and the entire plot. Are the numbers close? Which is more accurate and why?
2. Historic tree density in ponderosa stands averaged 70 to 100 stems per acre. Which of the two plots is more representative of historic forest conditions?
3. Ground cover and biodiversity are measures of forest health. What does your understory data tell you about the forest health in unthinned and thinned pine forests?



4. Compare the distribution of big and small trees in the two plots. What conclusions about forest health can you draw from your observations?
5. Make a statement about which forest stand is healthier. Support your statement with 5 observations you can make from the data.
6. In the thinned forest, the age on one tree with a 10-inch diameter is 80 years. In the unthinned forest, one tree with a 4-inch diameter is 85 years. Explain how this could happen.



Thinning Plan

Working with a group, look at the plot sketch on the Forest Plot Data Analysis Sheet. Decide if there are too many trees on the plot. If so, design a recommendation on how to make the forest healthier. Include instructions on how many trees should be removed from each acre. On your sketch of the unthinned plot, mark in red the trees you would recommend be removed. Justify your decisions on how many trees should be taken out, how many should remain, which trees should stay and which should be removed. Present your recommendations to the class.

EVALUATION

Students will be evaluated based on complete and detailed data analysis sheets, participation in class discussion, and an informed presentation based on their data analysis.

POTENTIAL RESOURCES

<http://www.greenforests.com/newsrel.html>

<http://www.wa.gov/dnr/htdocs/rp/stewardship/bfs/WESTERN/thinning>

<http://fire.nifc.nps.gov/fire/ecology/docs/construct.html>

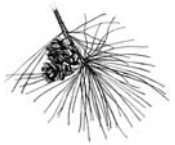
What does it all mean?



Forest Plot Data Sheet				Unthinned plot		
Subplot	1					
Tree	Tree circumference	Tree DBH	Tree basal area	Total number of trees in subplot		
1	13.7					
2	13.3					
3	20.6			Number of trees in plot (subplot multiplied by 4)		
4	23.4					
5	21.3					
6	18.9					
7	17.5			Number of trees per acre (number in plot multiplied by 4)		
8	23.1					
9	24.8					
10	17.5					
11	13.4			Average diameter of trees		
12	18.7					
13	19.6					
14	20.2			Total basal area of trees		
15	18.5					
16	7.2					
17	11.8					
18	15.6			Understory Sampling		
19	22.2			Sample	% cover	# of species
20	27.7			1	5	1
21	9.8			2	15	1
22	6.2			3	75	4
23	7.5			4	50	3
24	15.6			5	100	1
25	17.2			6	60	1
26	25.8			7	75	2
27	71.3			8	100	4
28	27.4					
29				Average percent cover		
30						
	Total			Average species diversity		

QUESTIONS

1. Make a statement about which forest stand is healthier. Support your statement with 5 observations you can make from the data.
2. In the thinned forest, the age of one tree with a 10-inch diameter is 80 years. In the unthinned forest, one tree with a 4-inch diameter is 85 years. Explain how this could happen.
3. Write a recommendation on how to make the unthinned forest healthier. Include instructions on how many trees should be removed from each acre. On your sketch of the unthinned plot, mark in red the trees you would recommend be removed.



What does it all mean?

STUDENT SHEET

Forest Plot Data Sheet

Subplot

1

Tree	Tree circumference	Tree DBH	Tree basal area
1	31.9		
2	42.1		
3	38.8		
4			
5			
6			
Total			

Total number

of trees in subplot

Number of trees in plot

(subplot multiplied by 4)

Number of tree per acre

(number in plot

multiplied by 4)

Average diameter of trees

Total basal area of trees

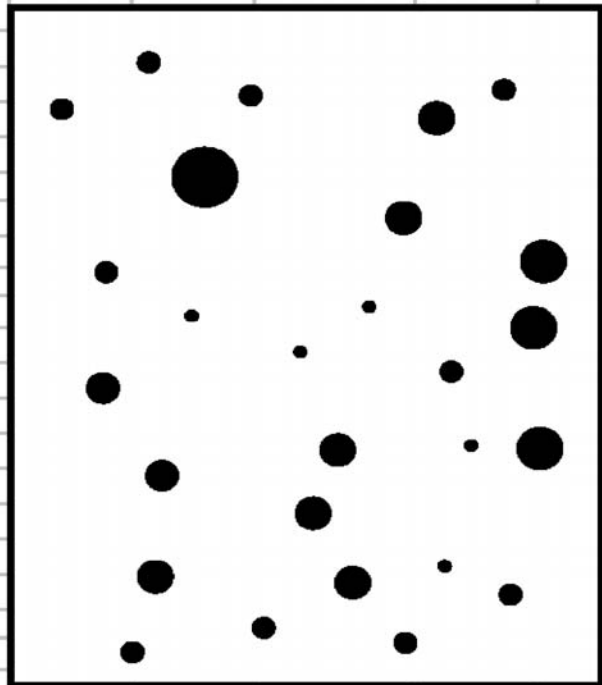
Thinned plot

Understory Sampling

Sample	% Cover	# of species
1	0	0
2	35	2
3	0	0
4	75	1
5	15	5
6	0	0
7	25	1
8	50	1

Average percent cover

Average species diversity



Unthinned plot sketch



EXPRESSING PERSONAL FEELINGS BASED ON OBSERVATIONS OF BURNED & UNBURNED FORESTS



FOCUS QUESTIONS

How can I express my feelings about the forest, both unburned and burned?

How can we create a forest landscape using photographic joiners in the style of David Hockney?

OVERVIEW OF LESSON PLAN

In the classroom, students will use the observations they made on the field trip in burned and unburned forests, then to express their observations and feelings in writing and in a photo collage in the style of David Hockney. From notes taken on the field trip, they will compose an essay or a poem. Using basic photography skills, they will design a photo collage from photos taken in the field.

SUGGESTED TIME ALLOWANCE: Class Time: 3 hours

LOCATION: Classroom, art room, computer lab (optional)

SUBJECT AREAS: Language Arts, Fine Arts, Technology

STUDENT OBJECTIVES

Students will:

- Express their observations and feelings in writing

- Research and study the works of David Hockney

- Communicate values, opinions, and personal insights through an original work of art

- Learn basic photography techniques

- Identify and describe the principles of design in visual compositions, emphasizing unity and harmony

- Learn perspective and planning techniques

- Assemble a quality photo collage using the style of David Hockney

- Work collaboratively sharing opinions and planning designs

MATERIALS

Writing exercise

- Pencils

- Field trip observation sheets

- Disposable cameras

- Computers and spreadsheet software word processing software (optional)

Photo collages

- Online or library resources on information about David Hockney

- Disposable cameras (26 color exposure)

- Workstation that allows space to spread photos out

- Masking tape



Rub-on glue sticks
Cardboard viewfinders, (optional for practice)
Photo quality paper for mounting photos
Framing materials (optional)

Post-Visit LESSON PLAN

PROCEDURES

Writing exercise

1. Have a class discussion about what the students observed in the burned and unburned areas. What was unique about both areas, and what characteristics did they share? Encourage the students to talk about how the burned forest made them feel. Are they hopeful, saddened, threatened, or able to see beauty there?
2. Working alone, have the students write one of the following forms, using their observation sheets as a starting point.
 - a. Write a compare and contrast essay
 - b. Write a pair of haiku to compare the areas
 - c. Write a pair of diamantes to compare the areas
 - d. Write a cinquain that summarizes their experience in the field
 - e. Write an acrostic on the trail they walked along, the fire that they studied, the name of where they live, or on PONDEROSA PINE.
3. After working through rough drafts, have the students publish their essays or poetry. Have each student enter their work into a word processing application. Students should choose a font that they believe best suits their words. Make a collection of the student work for a classroom portfolio.

Photo Collage

1. Develop film (4 x 6 double prints on a matt surface).
2. Return one set of prints to the student teams. (Extra set can be used as a backup or another collage).
3. Have students design their composition by laying out the photos so there is a slight overlap.
4. Before gluing, students should lightly tack each photo in place using masking tape.
5. When the design is approved students will carefully glue the photo to the paper.
6. A completed collage can be mounted and framed if desired.

EXTENSION ACTIVITIES

Create an exhibit of work in the local library or other public place.

Demonstrate how history, art, and culture can influence each other in making and studying works of art.

Visit museums and art displays.

Incorporate the use of at least one means of technology in creating an original work of art. For example use digital cameras in place of disposable cameras.



EVALUATION

Students will produce a writing sample and a photo collage. Students will be evaluated on photo composition, participation in class discussions, cooperation with their partner, and completed photo collages.



POTENTIAL RESOURCES :

<http://www.artchive.com/artchive/H/hockney.html>

<http://www.ibiblio.org/wm/paint/auth/hockney>

<http://www.getty.edu/art sednet/resources/Look/Landscape/hockney.html>

<http://www.mcs.csu Hayward.edu/~malek/Hockney.html>

<http://www.art andculture.com/cgi-bin/WebObjects/ACLive.woa/wa/artist?id=262>

WILDFIRE AND NATIVE PLANTS

DEVELOPING A FIELD GUIDE FOR NATIVE PLANTS



FOCUS QUESTIONS

What effect does wildfire have on plants?

What are the common types of plant species that inhabit your area after a forest fire?

OVERVIEW OF THE LESSON PLAN

In the classroom, students will refer to the plants they identified in the field and add information from other plant sources to complete their native plant field guide.

SUGGESTED TIME ALLOWANCE: 4 hours

LOCATION: Classroom

SUBJECTS: Science, Language Arts, Math, Art, Technology

STUDENT OBJECTIVES

Students will:

Complete plant data sheets for plants identified in the field.

Create personalized plant field guides.

Become familiar with utilizing commercial field guides and other resources.

VOCABULARY

Forest succession

Native plants

Adaptation

Phytophytes

Serotinous

Endangered species

MATERIALS

Websites, books, newspaper articles, encyclopedias

Pictures of common regional plants

Students sketches and/or photographs of plants

Plant data sheets

Science journals

Field guides of regional plant life

Computer with internet and data base access

Card stock, tag board, or other heavy paper

Colored pencils

Ruler

Scissors

Glue

Hole punch

Ribbon or yarn

Black felt tip pen for outlining

Misc. art supplies

PROCEDURES

1. PLANT DATA SHEET

Students will look up information on plants identified in the field in plant resource books or internet sources and complete the plant data sheet.

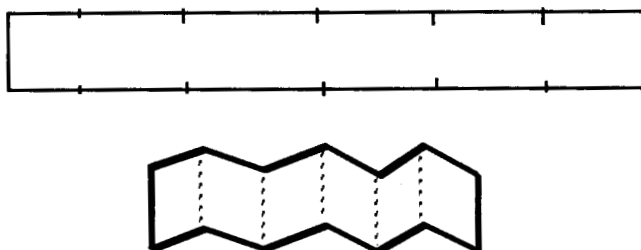
2. CREATING A FIELD GUIDE FOR NATIVE PLANTS

Field guides are books that contain photographs or accurate illustrations along with clear descriptions of plants. These guides are used by scientists, students and amateurs to help them identify species which they encounter but are unable to recognize. It is an essential tool in helping students identify plants they sketch, photograph, or collect.

There are many different ways to make a field guide. One approach is to make an accordion book. The zigzag shaped fold is best made with heavy paper, card stock tag board, preferably acid free. The stiff paper stands up well for a dramatic visual arrangement. Accordion books are easy to make and result in an interesting form for writing or drawing.

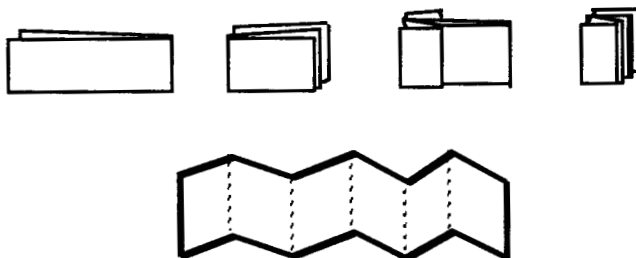
1. Method 1: Measuring

Carefully measure and mark equal page sections. Fold on the marks. Be careful to make the edges match perfectly.



2. Method 2: Folding

Fold in half repeatedly. Begin with the full length of the paper and fold in half perfectly. Next, fold each half in half, folding the edge back toward the center. Then fold each section in half again. As you fold, always watch that the edges match. Continue folding in half, then quarters, eighths, and sixteenths until the pages are the desired width.





3. Draw or glue plant photographs on paper. If using actual pressed plants lightly tack the plant specimen to the paper with Elmer's glue. Students can mix glue and water together in a shallow container, then apply with a small paint brush. Think sparingly, there is no need to coat the entire back of the plant with glue. Pre-cut clear contact paper slightly larger than the plant and carefully place it over the plant.
4. Write the information from the plant data sheet next to the plant. Check the data sheet beforehand for spelling accuracy.
5. Leave the front section for the cover.
6. Punch a small hole to insert a ribbon or piece of yarn to tie the finished guide together.

EVALUATION

Students will be evaluated on completed plant data sheets, participation in class discussions, participation in group work, and creation of a field guide of native plants

POTENTIAL RESOURCES

http://www.northmason.wednet.edu/HMHSonline/student_gallery/fire/c...

<http://pictures.discovery.com/dppages/wildfire/teacher/lesson1.html>

<http://horizon.msu.edu/ddl/pltcollguide.html>. <http://biology.arizona.edu/scicom/lessons2/Barber/PCDForm.htm>

Collecting and Preserving Plants by Ruth B. (Alford) MacFarlane Dover Edition 1994
ISBN: 0-486-28281-3

Botany in a Day by Thomas J. Elpel 4th Edition ISBN: 1-892784-07-6

Flowering Plants of the Southwestern Woodlands by Teralene Foxx and Dorothy Hoard 1995 ISBN: 0-9645703-1-9.



EXTENSION ACTIVITIES

Post-Visit LESSON PLAN

1. Invite speakers, such as the county extension agent, local nursery staff, master gardeners, and horticulture experts to share information with students.
2. Create a herbarium for your school. The purpose of a herbarium is to preserve specimens and share with others. Herbariums can be placed in a very visible place in the school office, library, or cafeteria.
3. Students can divide the preserved plants according to a category (e.g. habitat, medicinal or dye use, food, or woody, herbaceous, etc.) In cooperative groups they can create a presentation about their plant group. They can do a puppet show, an overhead presentation, or a computer presentation.
4. Research non-native invasive plant species on both disturbed and undisturbed sites.
5. After students have identified plants on the field trip have them choose a favorite species which they can research in greater depth.
6. For a science fair project study forest fire succession of plants. Identify different species of plants after a forest fire has occurred by counting the numbers of each species and measuring them. Discover what different species will grow back, what area grows the most diverse range of plants, and which areas have the most growth overall.
7. Look at plants on a north-facing slope and a south-facing slope and notice the difference.
8. Examine plants having different adaptive strategies for recovery and regeneration at different stages of the successional process and in different communities on a year-by-year basis.
9. Have students compile a class list of all the types of plants they discover in the field. Compare the list with the list developed by students in previous years.
 - a. What plants were found in all the years?
 - b. What plants are new this year?
 - c. What plants dropped off the list? Any ideas why?



10. Adopt-a-tree Observe a tree for a few months to see and document how it changes through the time you are watching it. Choose a deciduous tree and sketch it four times during the year. Visit the tree often to observe how it is changing. The intent of this exercise is to have the students observe how plants change over time, and to observe the nuances of the various stages of producing leaves, flowers, and other features if applicable.
11. More advanced students can make their own dichotomous key for their field guide. The key which they create can be placed at the beginning of the guide and used to help identify other plants in the field.
12. Invite younger students for a nature walk and have the older students show the children how to use the home-made field guides for identifying local plants
13. Via online communications, students can compare the types of vegetation found in their area to what students from other schools find. This can lead to many possible research questions. For instance, students in different locations could compare the effect of latitude, longitude, topsoil, depth, soil moisture or altitude on the vegetation of their respective areas.
14. Students might enjoy learning about how various plants are used in medicine, as food and fiber, or by wild animals, or how Native Americans or other cultures utilized plants. The creation of a field guide can be a springboard for many ethnobotanical explorations.
15. Create a bulletin board showing plant species from around the United States.





DEVELOPING A FOREST MANAGEMENT PLAN: MANAGING THE IMPACT OF WILDFIRE ON COMMUNITIES AND ECOSYSTEMS



FOCUS QUESTION

What can forest managers do to improve forest health and reduce the risk of wildfire?

OVERVIEW OF LESSON PLAN

In this lesson students will synthesize all the information gathered in the previous lessons to develop a forest management plan. Students will use real data from the Los Alamos area to analyze forest conditions and develop a plan to restore and maintain ecosystem health. This activity will simulate the decision-making process and develop awareness of the debates and issues involved in forest-management decisions.

SUGGESTED TIME ALLOWANCE: 4 hours

LOCATION: Classroom

SUBJECT AREAS: Language Arts, Social Studies, Science, Math, Technology

STUDENT OBJECTIVES

Students will:

- Evaluate information from a range of resources and suggest a forest management plan to support a given problem

- Utilize previous data collected in the field and collect new data

- Think critically and logically about the relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments

- Work collaboratively in small groups

VOCABULARY

- Forest Management Plan

- Resource Assessment

MATERIALS AND RESOURCES

- Field journals

- Pencils

- Forest Management Plan Worksheet

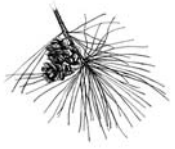
- Resource Assessment worksheets and maps

- Computers

- Internet Connection (optional)

PROCEDURE

1. Four resource assessments are provided. Divide students into management teams of from three to six students. Distribute the Forest Management Plan Worksheet and Resource Assessment for four areas. Class discussions will be more engaging if two teams of students work from the same resource assessment and students can compare the two approaches to the same problem.



Post-Visit LESSON PLAN

2. Explain to students that they will develop a forest management plan that will establish a framework that restores and maintains ecosystem health in a fire-adapted ecosystem. Brainstorm ways in which this can be accomplished. Review management strategies like forest thinning, prescribed fire, pre-commercial thinning, logging, and other ideas.
3. Review the guidelines for a forest management plan. Students should understand that they need to collect data from the Resource Assessment, and use that data to determine if their stand is healthy or if it needs management.
4. Using the resource assessment and map, have students fill in the Forest Management Plan Worksheet. Students should summarize the information on the background of the forest and its history from the resource assessment. Next, students should summarize the current conditions of their forest stand. How does this compare with conditions that we consider to illustrate healthy stands of ponderosa pine?
5. Student should research methods of forest management on the Internet and in the library. Each group should decide which method or combination of methods would work best on their forest stand.
6. After students have produced their Forest Management Plan, they will make a presentation to the class.

EVALUATION:

Students will be evaluated on participation in class discussions, and completion of the Forest Management Plan.

EXTENSION ACTIVITY

Students may want to present their ideas at a community meeting, or publish their Forest Management Plan in the local newspaper or website.

GUIDELINES FOR DEVELOPING A FOREST MANAGEMENT PLAN

Adopted from The Forest Management Plan by the School of Forest Resource and Conservation, University of Florida



A forest management plan is a specific guideline for the way a stand of the forest is managed. The plan has a definite goal for the forest, and details a series of activities that will take place in order to meet that objective. In essence, a management plan will guide you from where you are to where you want to be. In this lesson, you will be given a resource assessment of the current conditions of a forest. You will determine if the forest is unhealthy and if it can be improved by specific treatments.

The information in your management plan should be simple, but with enough detail to be useful. Most management plans are designed to be reviewed every five to ten years, with adjustments made to accommodate the continually changing environment (from fire and bugs to landowner objectives) that is part of the natural resource management.

Parts of a Management Plan

- A statement of objectives
- A summary of the forest location and history
- A resource assessment that summarizes current conditions
- Management recommendations to reach the objectives
- An activity schedule of what will be done and when
- A description of what the forest will look like in the future

1. Statement of Objectives

An objective is a desired outcome or future condition for your forest. Your objective will be to restore healthy and fire safe conditions in the forest by changing current conditions to more closely match those of the past.

2. Property Location and History

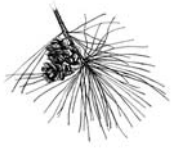
Your management plan should include a description of your land taken from the resource assessment and map that you will be given. It should include a brief summary of the management history of your forest. Has it been cleared for recreation? Is there evidence of any other uses in the past? This information will give you some idea of your land's potential and may give you clues about what can be done with it.

3. Summary of the Resource Assessment

Using the resource assessment, provide your plan with descriptive information about the natural resources on your land. It may include information such as stand types (e.g., dominant species, ages, understory), other vegetation communities, soils, water bodies, historical features, wildlife uses, and recreational opportunities. Summarize everything you know about your forest.

4. Management Recommendations

Based on the resource assessment and your specific objectives, make recommendations for the entire stand of forest. Recommendations should outline a general set of treatments or operations to be done over a long term, with a



discussion of the expected results of each management action. General recommendations should be supplemented with specific recommendations, which are usually designated for five-to-ten year blocks of time. Specific recommendations may include the forest regeneration method(s) to use, where to plant wildlife food plots, when and where to burn, and which areas to remove trees.

5. Activity Schedule

Create an activity schedule that tells when each recommended treatment will take place. Tell what you expect to accomplish with each treatment and why it is being done at a specific time.

6. Conclusion: The Future Forest

Describe what your forest will look like when treatment is done, in one year after treatment, in 5 years after treatment, and 50 years after treatment.

POTENTIAL RESOURCES

<http://www.sfrc.ufl.edu/Extension/ffws/mp.htm>

<http://www.eri.nau.edu>

FOREST MANAGEMENT PLAN WORKSHEET



Date: _____

Names of Team Members:

Location of Forest Stand:

Property Location and History:

Summary of the Resource Assessment:

Objectives of the Forest Management Plan:

Management Recommendations for the Forest Stand:

Activity Schedule for Forest Management:

Conclusion: What will the Forest Stand Look Like at One, Five and Fifty Years in the Future?

STUDENT SHEET





37 acres

A plot study in the forest area found that 100 percent of the trees were ponderosa pine. The tree density averaged 730 trees per acre. The average diameter breast height of the trees was 10 cm. Only 10 large trees per acre are found on the site. Most of the trees form thick stands. The older trees are found in clumps of 3 to 6 trees. The small trees are all about 20 feet high. The large trees are up to 80 feet tall.

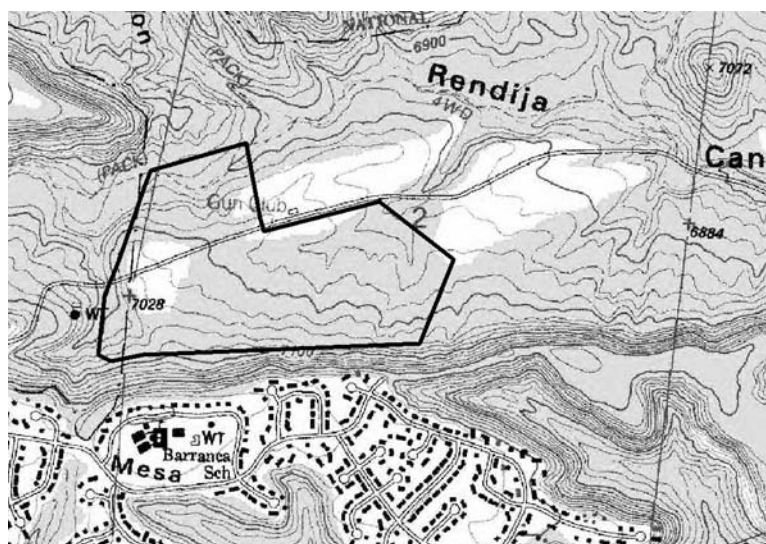
In the understory, the average number of species was 2. The ground is covered with a thick layer of pine needles. Plant cover averages about 20% of the ground. Thistle and cheat grass are common.

The forest is on the south slope of a canyon that runs out of the Jemez Mountains. The canyon is about 300 feet deep. The canyon walls are steep, but the forest sits on a flat spot above the canyon bottom. A stream channel is at the canyon bottom, but water flows in the channel only about 12 days a year. The forest is next to a recreational trail that is used by hikers, runners, horseback riders, mountain bikers, and motorcycle riders.

At least one archeological site is within 200 feet of the forest. It is an old village that was occupied around 1400. One-quarter mile downstream is a field from a homestead that was used around 1920. An old road runs up the canyon bottom.

Two endangered species are found in the canyon. Spotted owls live in the old standing dead trees. Peregrine falcons nest in the canyon walls.

Houses are found on the mesa south of the forest. The houses are about one-quarter mile away.



93 acres

A plot study in the forest area found that 80 percent of the trees were ponderosa pine and 20 percent were Gambel oak. The tree density averaged 510 trees per acre. The average diameter breast height of the trees was 50 cm, but some trees were 75 cm in diameter. About 25 percent of the trees were big trees. Some of the trees form thick stands. The older trees are found in clumps of 3 to 6 trees. The trees varied in size from 3 feet tall to 40 feet tall. The large trees are 100 feet high or more.

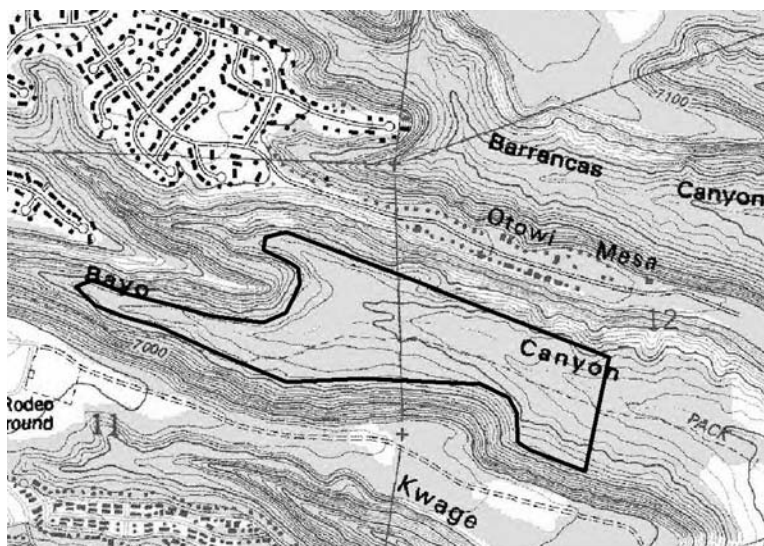
In the understory, the average number of species was 10. The ground is covered with a thick layer of tall grasses. Plant cover averages about 80% of the ground. Lots of dead wood is lying on the ground.

The forest is on the bottom of a wide canyon that runs out of the Jemez Mountains. The canyon is about 300 feet deep. The canyon walls are steep, but the canyon bottom is about one-quarter mile wide. A stream channel is at the canyon bottom, but water flows in the channel only about 12 days a year. The forest is next to a recreational trail that is used by hikers, runners, horseback riders, and mountain bikers.

One large archeological site is within a mile of forest. It is an old village that was occupied around 1400. An old road runs up the canyon bottom.

Two endangered species are found in the canyon. Spotted owls live in the old standing dead trees. Peregrine falcons nest in the canyon walls.

Houses are found on the mesas north and south of the forest. The houses are about one-quarter mile away. Many trees are found on the north slope of the canyon near the houses. A fire behavior study found that under dry conditions a fire start in the canyon bottom would spread at a rate of 3,000 feet per hour. Such a fire would reach out of the canyon in 15 minutes.





64 acres

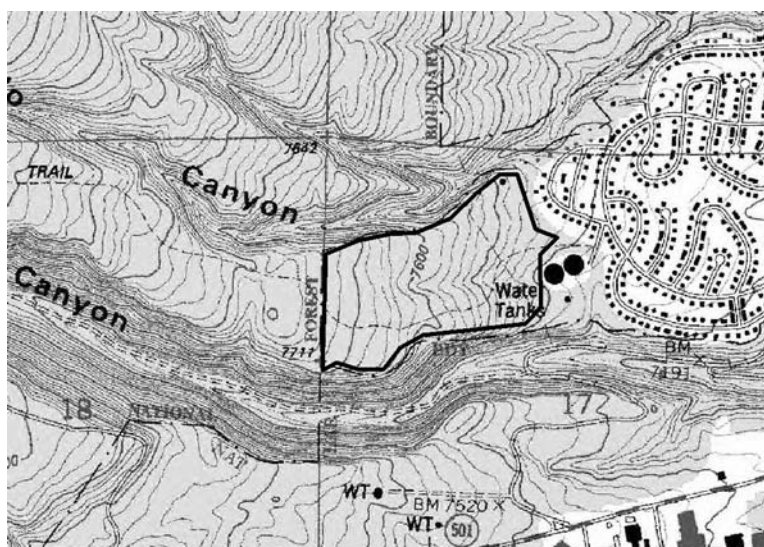
A plot study in the forest area found that 95 percent of the trees were ponderosa pine and 5 percent of the trees were aspen. The tree density averaged 660 trees per acre. The average diameter breast height of the trees was 15 cm. About 20 large trees per acre are found on the site. Most of the trees form thick stands. The older trees are found in clumps of 3 to 6 trees. The small trees range from 10 to 40 feet high. The large trees are up to 80 feet tall.

In the understory, the average number of species was 6. The ground is covered with a thick layer of pine needles. Grasses up to 2 feet high cover about 20 percent of the ground. Total plant cover averages about 60% of the ground. Thistle and cheat grass are common.

The forest is on a long mesa that extends east from the Jemez Mountains. The mesa is about 400 feet above the surrounding canyons. The canyon walls are steep, but the forest sits on flat ground. The forest has a recreational trail that is used by hikers, runners, and mountain bikers. The trail is an old road that runs up the mesa.

Two endangered species are found near the mesa. Spotted owls live in the old standing dead trees. Peregrine falcons nest in the canyon walls.

Houses are found on the flat ground northeast of the forest. The houses are about one-quarter mile away. In spring, the wind usually blows from the southwest. A fire behavior study found that under dry conditions a fire start in the canyon bottom would spread at a rate of 3,000 feet per hour. Such a fire would reach the houses near the mesa in 15 minutes.



47 acres

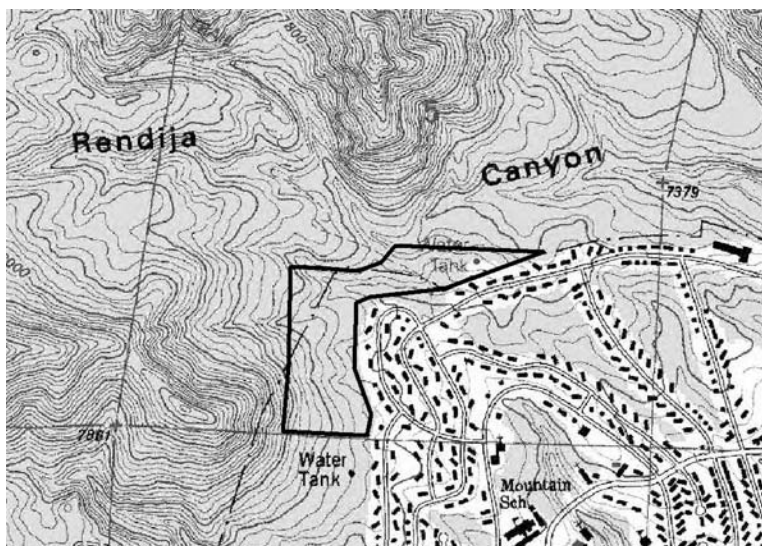
A plot study in the forest area found that 100 percent of the trees were ponderosa pine. The tree density averaged 540 trees per acre. The average diameter breast height of the trees was 10 cm. Only 10 large trees per acre are found on the site. Most of the trees form thick stands. The older trees are found in clumps of 3 to 6 trees. The small trees range from 10 to 40 feet high. The large trees are up to 80 feet tall.

In the understory, the average number of species was 4. The ground is covered with a thick layer of pine needles. Plant cover averages about 20% of the ground. Thistles and cheat grass are common.

The forest is on the south slope facing Los Alamos. The nearby canyon is about 100 feet deep. The canyon walls are steep, but the forest sits on a flat spot above the canyon bottom. The forest is next to a recreational trail that is used by hikers, runners, horseback riders, mountain bikers, and motorcycle riders.

Two endangered species are found near the mesa. Spotted owls live in the old standing dead trees. Peregrine falcons nest in the canyon walls.

Houses are found on the flat ground right on the edge of the forest. In some cases, the forest canopy extends right up to the houses.





BE PREPARED: CREATING A DEFENSIBLE SPACE



FOCUS QUESTION

What is defensible space and can it help save a house when a wildfire strikes?

OVERVIEW OF LESSON PLAN

In this lesson students will learn the principals of creating an effective defensible space around their home and property. They will learn the definition of defensible space and brainstorm ideas on how it is created. Using firesafe guidelines they will plan and create a fire-wise landscape design that will help protect their home from wildfires.

SUGGESTED TIME ALLOWANCE

4 hours classroom

2 hours homework

SUBJECTS: Science, Language Arts, Math, Art

STUDENT OBJECTIVES

Students will:

- Discuss the meaning of defensible space.

- Compare homes that have reduced the risk from wildfire and those that have not.

- List ways they can HELP protect their home from wildfires.

- Develop a Wildland Fire Hazard Severity Assessment Form.

- Plan a firewise landscape design that will meet the needs of their home and property.

VOCABULARY

Defensible space

Removal

Reduction

Replacement

Vegetation

Ladder Fuels

Combustible Debris

Separation distance

Thumbnail sketch

TEACHER BACKGROUND INFORMATION

People who live in high risk wildfire areas are faced with the growing concern that a wildfire could damage or destroy their home and property. Every year many families lose their homes and possessions to wildfire. These losses can be minimized if homeowners take a pro-active approach to home safety. When homeowners take the time to become aware of appropriate safety measures and put forth the effort to implement those measures, they often greatly improve the ability of fire fighters to protect their homes, and will reduce their vulnerability to the destructive forces of fire.



Defensible space is one of the primary determinants of a structure's ability to survive a wildfire. The goal of creating defensible space is to develop a landscape that provides an opportunity for firefighters to defend a structure against fire. When grasses, brush, trees, and other common forest fuels are removed, reduced, or modified in a yard, a fire's intensity or nearness to a structure decrease. That situation provides a space for firefighters to battle the blaze. Defensible space is not a guarantee that a structure will survive, but it often increases the chances of protection from wildfire.

MATERIALS

- Field journals
- Scratch paper 9x12
- 1 inch grid graph paper 34x26 (cut in half)
- Rulers
- Pencils
- Pink pearl erasers
- Colored pencils
- Prismacolor watercolor pencils (optional)
- Sharpie ultra fine markers
- Tag board
- Timer
- Firewise landscaping checklist

PROCEDURES

Warm-Up

Show an example of a typical house before defensible space measures have been applied. Ask students to list potentially flammable materials. What are some measures that could be taken to protect this home from wildfire? Are some homeowners reluctant to make changes that could reduce the threat of wildfire? Why?

Next show a picture of a home that has reduced the risk from wildfire by using defensible space measures. What differences do you see in the two pictures? If a wildfire came through your neighborhood, could your house survive on its own?

Group Discussion on Defensible Space

Write the definition of defensible space on the chalkboard. (Defensible space is an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure and to provide a space for firefighters to work).

Strategy: Think-Pair-Share

Instruct students to: Think of three ways that you can reduce fire risk around your home. Take a minute to allow your thoughts to flow. After a minute of silent time pair off with the person next to you and tell each other your ideas and thoughts. After another minute tell students you will be asking some of them to share your ideas with the entire class.



For the first minute you will THINK individual and silent think time
For the next two minutes you will be part of a PAIR discussion with your partner
Lastly some will SHARE ideas class discussion

VARIATION: Think Pair Write or Think Write Pair

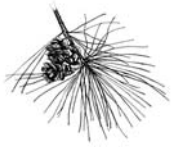
Strategy: Brainstorming

Creating a truly defensible space requires that homeowners maintain their whole property. What are some ways that property owners can reduce the risk of wildfire? Develop and post a working list that can be added to during the unit.

1. Hand out a copy of the firewise landscaping checklist. Ask students to read over the list and note the items that are already there. Discuss the contents of the list.
2. Students will work in teams of 4 to develop a risk assessment form. What are the most hazardous / troublesome issues a firefighter would identify in trying to protect a property?
3. Review the professional Wildland Fire Assessment Form that is often used for professional assessments. What hazards did you catch? Which did you miss? How might you customize your form (having seen the professional one) to get a final assessment tool?
4. As a homework assignment each student will take the form home and assess their own home and property and discuss with their parents what can be done to improve their risk of wildfire damage.
5. Students can then design a defensible space plan for their home (see below).

PROCEDURE FOR DEFENSIBLE SPACE DESIGN

1. In their field journals students will list all the steps they need to take to reduce the risk of wildfire damage to their home and property.
2. Beginning with scratch paper they will construct a thumbnail sketch of their home and develop a defensible space landscape. (Thumbnail sketches are very quick, loose drawings. Sometimes they look a little messy but they help with the planning of the design without having to worry about making mistakes.) (It helps to have students work from photographs of their homes; using front, side, and back views.)



3. After careful editing of the rough draft plan, students are ready to draw their design on graph paper. Stress that they lightly draw where they want things to go and fill in the details later. Color should be added sparingly after the design is complete. Markers are not recommended as they bleed through the paper. A list of at least five or more changes should be typed and attached to the finished project.
4. Glue the finished graph paper to tag board for support and laminate if desired.
5. Share the finished projects with the class and display in a suitable location.

EVALUATION

Students will be evaluated on participation in class discussions, group work, completed defensible space designs, and informed presentations.

EXTENSION ACTIVITIES

Write an essay on how you can increase community commitment and participation regarding defensible space.

Design an exhibit such as Who Wants to be a Wildfire Survivor?

Design a defensible space plan for your neighbor.

Invite a local builder to the classroom and discuss firewise construction methods used.

Design a new house with recommended defensible space suggestions.

Present student designs at a local community firewise meeting.

Conduct a survey with community members. Address these questions: What did you know about the history and health of your forests? What did you know about the risk of wildfire? What did you know about fuel/hazard mitigation? How could land and resource managers and other officials better communicate with the public? Hold a public meeting and share the results

POTENTIAL RESOURCES :

<http://www.firesafeidyllwild.org/firesafeweb/defensibleSpace/step1/dist...>

<http://www.usfa.fema.gov/safety/landscape.htm>

<http://www.firewise.org>

Name _____



Be Prepared: Creating a Defensible Space Assessment Questions

Comprehensive Paragraph: List three or four things a person can do that will make your house safer from wildfire. Then write a short explanation of why your list will work.

Matching:

Defensible space	a. fuels that provide vertical continuity between the surface fuels and crown fuels in a forest stand, thus contributing to the ease of torching and crowning.
Removal	b. items that catch fire and burn easily; flammable
Reduction	c. eliminating entire plants, particularly trees and shrubs, from a site.
Replacement	d. clearing away plant parts, such as branches or leaves. An example would be pruning dead wood from a shrub.
Ladder Fuels	e. what you do when you substitute a less flammable plant for a more hazardous type of vegetation.
Combustible Debris	f. an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire.

True or False:

1. Creating a truly defensible space requires that homeowners maintain an area of at least 15 ft. from the house.
a. True b. False
2. Removing or reducing grasses, brush and trees from near a structure will always keep a home from burning.
a. True b. False

Multiple Choice:

What is the primary way of saving a structure from wildfire?

- | | |
|--|-------------------------------|
| a. creating defensible space | b. install room extinguishers |
| c. coat the roof with a fire retardant paint | d. remove all crowning fuels |

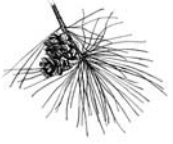
Combustible debris includes which of the following?

- | | |
|--------------------------------|-------------------------|
| a. old dry limbs | b. newly planted shrubs |
| c. cedar shingles on the house | d. all of the above |

Which of the following is not an effective method of creating defensible space?

- | | |
|--------------------------|--------------------------|
| a. removal of vegetation | b. reducing vegetation |
| c. replacing vegetation | d. replanting vegetation |





BE PREPARED: CREATING A DEFENSIBLE SPACE
ASSESSMENT TEACHER MASTER SHEET

TEACHER MASTER

Comprehensive Paragraph: List three or four things a person can do that will make your house safer from wildfire. Then write a short explanation of why your list will work.

Becoming aware of dangers through education.
Replacing and replanting vegetation.
Removing, reducing, or modifying landscape.

Matching:

Defensible space f
Removal c
Reduction d
Replacement e
Ladder fuels a
Combustible debris b

True or False:

1. Creating a truly defensible space requires that homeowners maintain an area of at least 15 ft. from the house. False
2. Removing or reducing grasses, brush and trees from near a structure will always keep a home from burning. False

Multiple Choice:

What is the primary way of saving a structure from wildfire?
a. creating defensible space

Combustible debris includes which of the following?
d. all of the above

Which of the following is not an effective method of creating defensible space?
c. replacing vegetation